# TURBULENTE STRÖMUNGEN
# WS 2015/16
# Lecture dates: Tuesday, 12:15 – 13:45
# Problem session dates: Wednesdays, 15:15 – 16:00
# Location: Seminarraum (ITV)

**Instructor:** Taraneh Sayadi, Tel.: 0241 – 80 94607
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**Credits:** 4

**Text:** Turbulent Flows, S. B. Pope (required)
Other texts for further reading (not required):
Turbulente Strömungen, Julius C. Rotta
(Can be downloaded for free at:
http://www.goedoc.uni-goettingen.de/goescholar/bitstream/handle/1/6357/Rotta.pdf?sequence=1)
Statistical Theory and Modeling for Turbulent Flows,
P. A. Durbin & B. A. Pettersson Reif
A First Course in Turbulence, H. Tennekes & J. L. Lumley

**Course Objective:** Turbulence is different from the courses you have taken so far. Here, equations will be important, but much of the theory is based on scaling arguments. The comprehension of dimensional analysis and scales will be important. The objective of the course is to provide the theory and knowledge for understanding, for example, of publications and seminar talks on the subject, and to serve as a basis for making contributions to the field.

**Problem Sessions:** Weekly problem sets will be available online (please register online for the L2P learn room at Campus Office). The problems will be solved during the exercise courses. Solutions will be posted online.

**Matlab:** We will use Matlab for some of the exercises. Matlab is available free of charge for students at the RWTH (log on to the Campus Office -> Online Shops -> Softwareportal). Download and install “Matlab Campus-Lizenz für Studierende”.

**Exams:** Final Quiz (date and location TBA)

**Grades:** Final Quiz: 100 %

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| WEEK | LECTURES + EVENTS | Reading |
|---|---|---|
| 20.10.2015 | Introduction to Turbulence | |
| | Equations of Fluid Motion | Chap. 2 |
| 27.10.2015 | Statistical Description of Turbulence | Chap. 3 |
| 03.11.2015 | Mean Flow Equations | Chap. 4 |
| | **Tutorial:** What you always wanted to know about Cartesian Tensors | App. A |
| 10.11.2015 | Turbulent Round Jet | Chap. 5.1-5.2 |
| 17.11.2015 | Turbulent Kinetic Energy | Chap. 5.3 |
| | **Tutorial:** What you always wanted to know about Fourier Transforms | |
| 02.12.2015 | Mixing Layer, Homogeneous Shear Flow | Chap. 5.4-5.5 |
| | Grid Turbulence, Intermittency | |
| 09.12.2015 | Energy Cascade, Kolmogorov Hypotheses | Chap. 6.1-6.4 |
| 16.12.2015 | Energy Transfer | |
| 06.01.2016 | Velocity Spectra | Chap. 6.5-6.6 |
| | Kolmogorov Spectrum | |
| 13.01.2016 | Channel Flow | Chap. 7.1 |
| | Boundary Layer | Chap. 7.3 |
| 20.01.2016 | Coherent Structures | Chap. 5.5.4 + 7.4 |
| | **Tutorial:** What you always wanted to know about Direct Numerical Simulations | |
| 27.01.2016 | Turbulent Viscosity Models | Chap. 10 |
| 03.02.2016 | Large-Eddy Simulations | Chap. 13 |